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Backgrounder

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The Marginal Effective Tax Rate: The Only Tax Rate that Matters in Capital Allocation

Duanjie Chen

To decide where to invest capital, firms facing equivalent business opportunities in competitive markets need to know the effective tax rate that will bear on an incremental dollar of investment. Given equivalent investment options, the marginal effective tax rate will make or break a project. This note, which focuses on the tax environment in the NAFTA area, explains how that rate is properly estimated, and shows that the climate for investing in manufacturing is more hospitable in the United States — and still more hospitable in Mexico — than it is in Canada. Furthermore, the relative tax burden is much higher for the Canadian services sector, and this tax distortion may be a concern if a growing knowledge-based economy is a policy target. Decisionmakers in the Canadian private and public sectors should understand why and how effective tax rates are calculated, and why and how they affect economic outcomes.

Policymakers have become increasingly sensitive to the role taxes play in attracting or repelling foreign capital; in response, some governments have taken steps to make their jurisdictions friendlier. This tax competition has stimulated a great deal of study of the capital allocation decision, focusing in particular on determining which measure of the tax rate matters in economic decisionmaking.

The emergent consensus is that only the *marginal* effective tax rate (METR), rather than the statutory or average effective tax rate (AETR), matters in capital allocation. This *Backgrounder* aims for practical clarity: How should one estimate and interpret the METR within a capital allocation framework? What policy implications can one draw from analysis of the METR?

The Concept of the METR

The METR is the tax rate that bears on an incremental dollar of income from investment. For illustration, consider two hypothetical cases.

In case 1, a Canadian firm wishes to diversify through new capital investment within Canada, and the pre-tax risk-return profile is assumed to be the same across sectors.[1] The firm's investment decision will therefore depend on which sector bears the lowest effective tax rate on capital investment in Canada.

In case 2, an established Canadian manufacturer wishes to expand its mature manufacturing line somewhere within the North American Free Trade Area (NAFTA) — that is, its investment location will be chosen from among Canada, the United States, and Mexico. In each case, the project's risk-return profile is assumed to be the same. Thus, the firm's investment location decision will depend on which country taxes the net return on capital investment under the most favorable terms.

In either case, in considering a new investment the firm will, like any rational investor, allocate capital to maximize profit. Common sense says that, in a market with free entry, profit from every dollar invested will grow as long as the *revenue* from the last dollar invested (that is, the marginal revenue) is greater than the *cost* of the last dollar invested (that is, the marginal cost). Profit from the total capital investment is therefore maximized when the marginal revenue equals the marginal cost.

Tax policy affects both marginal revenue and marginal cost. Taxes themselves reduce marginal revenue, while tax allowances reduce marginal cost. At the *profit-maximizing* point, the combined effect on marginal revenue (or marginal cost) is the marginal effective tax rate: the tax wedge between the pre-tax and post-tax rates of return to capital, expressed in percentage terms. Given that all non-tax considerations are equal, an investor will invest in the sector or geographic location where the METR is lowest. In other words, to the extent taxes play any role in an investment decision, what really matters is the METR.

The Difference between the METR and the AETR

It is easy to confuse the AETR and the METR in analyzing the effects of tax, since the difference between the two appears to be a minor matter of arithmetic.

The AETR is a numeric ratio of total taxes to pre-tax return for a set of one or more investment projects; it is a number often featured in income statement analysis, but one with limited use in decisionmaking. While the METR is a well-founded economic concept, the AETR lacks *ex ante* meaning since it is marginal, not average, factors that drive investment decisions. Moreover,

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1 The provinces differ in the way each treats capital taxation. For simplicity, this analysis focuses on sectoral differences and treats Canada as a whole by way of a weighted average of provincial income and capital tax rates within each sector.

"effective" in these two contexts carries different meanings. In the METR, "effective" emphasizes the need to take into account all tax provisions — not just statutory tax rates but also tax allowances and other provisions such as loss-carry-over rules, inventory accounting methods, thin-capitalization rules, and so on. In the AETR, "effective" measures the tax costs actually incurred, and reflects the non-tax features of those specific projects. Moreover, the AETR implicitly captures tax liability associated with projects already undertaken (whether or not they are profitable) and could easily be higher or lower than the marginal rate that will bear on marginal investment projects.

In other words, the METR measures the expected effective tax rate produced by the formal tax structure, assuming profit-maximizing behavior by investors. In contrast, the AETR is a realized tax rate that is sensitive to the business performance of a specific taxpayer or group of taxpayers and that therefore reflects past tax planning choices; the AETR is not suitable for evaluating tax impacts across assets sectors or jurisdictions.

The METR Calculation

The METR is the effective tax rate on marginal revenue, or the revenue generated from the last unit of capital invested. The assumption that firms are profit maximizers allows the calculation of the METR to begin with marginal revenue equaling marginal cost. Since it is marginal cost, rather than marginal revenue, that is observable, the METR is evaluated as the effective tax cost as a share of marginal cost, net of economic depreciation.

For depreciable assets such as machinery or structures, the marginal cost is the sum of the financing cost and the economic depreciation rate. Tax rates and tax allowances are offsetting factors in the computation of marginal cost — two obvious examples are tax deductibility for finance costs, and the capital cost allowance, which is often more generous than the true rate of economic depreciation.

Firms pay income taxes on the revenue generated by their capital investment, but they reduce their financing cost by writing off the cost of debt when calculating taxable income. They may also defer tax liabilities arising from the gap in timing between tax depreciation and accounting depreciation (the latter usually being closer to the economic depreciation rate). The pre-tax rate of return on capital is estimated as the pre-tax cost of capital — net of economic depreciation; the METR is the wedge between that rate of return and the post-tax return on capital, expressed as a proportion of the pre-tax return. For example, if the pre-tax rate of return on capital is 20 percent at the profit-maximizing point, and the post-tax rate of return on capital is 10 percent, the METR is 50 percent. Thus, the effective tax rate on income on the last dollar invested (that is, at the profit-maximizing point) would be 50 percent.

This description of the METR calculation is not limited to depreciable assets: it can be applied to nondepreciable assets, such as inventory and land, where the tax depreciation and economic depreciation rates are both zero. (Restrictions on inventory accounting for tax purposes may cause further

complications, as discussed below.) And given an METR for each type of asset and industry-specific estimates of capital structure, the METR for an entire industry can be expressed as a weighted average of METRs for each type of asset.

Other taxes, such as property taxes or taxes on capital in place, may enter into and complicate the equation, but the principle is the same: the METR measures the impact of tax on the income generated by an incremental dollar of capital investment. And profit-maximizing firms base their investment decisions on the present value of foreseeable incremental revenues less the incremental cost of capital.

The Effect of Non-Tax Items on the METR

Non-tax factors naturally affect the METR; when combined with tax effects, they may cause allocative distortions that legislatures did not intend. For analytical purposes, in order to single out the tax impact it is common to assume that all non-tax factors are the same across sectors or jurisdictions, enabling a baseline METR calculation and comparison. Then, the variation in non-tax factors between sectors and jurisdictions may be introduced, revealing the interaction between tax and non-tax factors. Following are a few examples of how non-tax factors may affect METR estimates.

Inflation

Inflation affects the METR through its impact on cost deductions, including the nominal interest rate. For a given real interest rate, the higher the inflation rate, the higher will be the nominal interest rate. Inflation interacts with taxes mainly through three channels.

The first channel flows from the fact that the nominal cost of borrowing is usually deductible for income tax purposes. As a result, the higher the inflation rate (hence the higher the nominal interest rate), the lower will be the post-tax real financing cost and the lower the METR. (This effect is particularly evident for leveraged land financing, since the only cost of capital invested in land is financing cost.)

Second, a higher inflation rate implies a higher nominal discount rate for future tax allowances, which, in turn, implies a lower present value for future tax depreciation allowances. This raises the METR on depreciable assets.

The third channel depends on the inventory accounting method. If, as in Canada, the first-in-first-out inventory method is required for tax purposes, inflation may cause excess reported taxable income, since inventory is written off at historical prices but replaced at higher current prices. As a result, the METR on income generated by investment in inventories will be higher than otherwise.

Since inflation has opposing effects on the METR on different assets, its net impact on the overall METR will depend on the capital structure in a given

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industry. In the case of Mexico, capital income and capital costs are indexed for inflation in calculating taxable income, so inflation has little impact on the METR.

The Debt-to-Assets Ratio

The ratio of debt to assets is sometimes referred to as the financing structure. The impact of that structure on the effective tax rate is related to the expected inflation rate. For a given inflation rate and without any restriction on the nominal interest deduction, the higher the debt-to-assets ratio, the greater will be the potential benefit of tax deductibility for interest expenses. A higher debt-to-assets ratio may thus reduce the METR.

Economic Depreciation

The METR is also affected by the interaction of the economic depreciation rate and the tax depreciation allowance. For a particular machinery type and a given economic depreciation rate, a higher tax depreciation allowance generates higher benefits through tax deferral. For example, if capital and technology are fully mobile, an investor should depreciate a particular type of machinery at the same economic rate everywhere around the world. But given equivalent tax rates, the METR on capital invested in such machinery will be lower in jurisdictions with higher tax depreciation allowances.

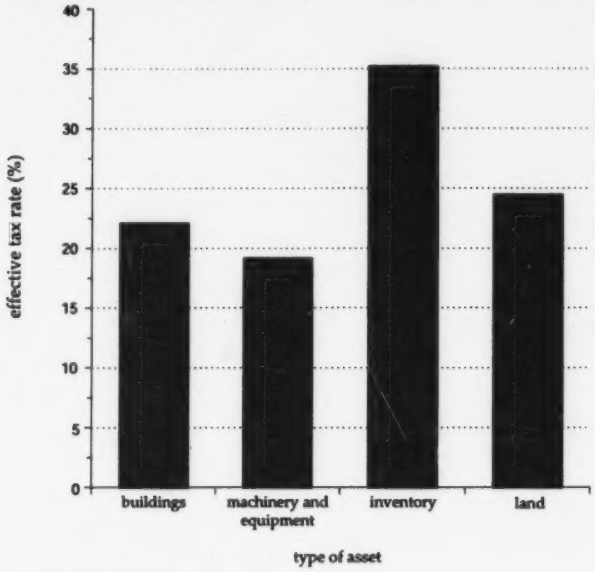
Capital Structure

A capital investment usually involves depreciable and nondepreciable assets. These categories can be further divided into four major types: structures, machinery, inventory, and land. Capital investments in different industries normally involve different mixes of assets. Moreover, with the same statutory tax rates, different types of assets may be subject to incur different effective tax rates owing to the interactions between tax and non-tax factors. As a result, an industry with a higher capital share in higher-taxed assets tends to be exposed to a higher METR as a whole.

The Policy Implications of METR Analysis

METRs allow one to compare tax rates across different types of assets, business sectors, and tax regimes. Variations in METRs indicate a tax distortion within a tax regime or give one regime an advantage over others. If a tax regime's statutory tax rates are the same across different assets and business sectors, then a tax allowance scheme that favors certain asset types over others can cause cross-asset or cross-sector tax distortion — and this is revealed by the METRs. Such distortions can be remedied by reforming the tax allowance scheme to level the playing field across asset types and business sectors. If a tax regime appears to be disadvantageous[2] relative to competing

Figure 1: METRs on Capital by Asset Type for Large Firms, Canada, 2000



Source: Author's calculations.

jurisdictions, changes in statutory tax rates or tax allowances may be necessary.

METRs by Asset Type

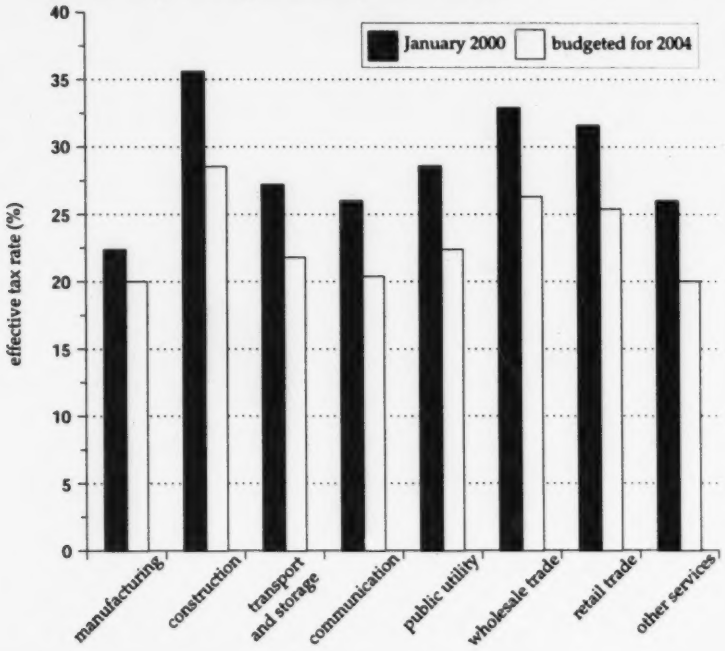
As an illustration of how METRs are calculated,[3] see Figure 1, which shows METRs on capital by asset type for an average large nonresource firm in Canada (a weighted average across industries). By "METRs on capital," I mean METRs on income generated from that type of capital. For example, if the METR on machinery is 20 percent, the METR on income generated from capital invested in machinery is 20 percent.

Of the four major types of capital (inventory, land, buildings, and machinery) in which an average Canadian firm invests at home, the one taxed most highly is inventory, while machinery is taxed the least. This is mainly because Canada's income tax system, in order to encourage capital investment in machinery, provides a very generous capital cost allowance for such equipment. The much higher METR on inventory is mainly a result of the tax-reporting requirement that the first-in-first-out accounting method be

2 A tax disadvantage is not always associated with a relatively high METR. When a foreign investor is taxed globally at home under a typical foreign tax credit scheme, lowering the METR in the country that hosts the investment may cause some of the tax liability to shift to the home country.

3 Tax provisions are those in effect as of January 2000, unless otherwise specified. Calculations are based on an expected inflation rate of 1.7 percent in Canada, an average debt-to-assets ratio of 40 percent across sectors and countries, and a real interest rate of 6 percent. Capital structure estimates are adopted from McKenzie, Mansour, and Brûlé (1998).

Figure 2: *Effective Corporate Taxes Rates on Capital Investment for Large Firms by Industry in Canada, 2000 and 2004*



Note: Budgeted rates are those proposed in the 2000 federal and Ontario budgets.

used. As mentioned above, this accounting method may cause taxable income to be inflated[4] when prices are rising. If the last-in-last-out method were permitted, there would be no inflated taxable income related to inventory and the METR on inventory would be as low as that on land (25 percent).

The METR on buildings is higher than that on machinery because the tax depreciation allowance for buildings (relative to their economic depreciation rate) is less generous — the allowed rate for buildings is probably closer to the economic depreciation rate, while that for machinery typically exceeds economic depreciation. The METR on land is second-highest among the asset types because no depreciation is allowed for it. Perhaps more important, the only capital cost associated with land is financing, part of which will usually be debt, whose servicing cost is a deductible expense. As a result, the lower the inflation rate — hence the lower the nominal interest rate —the higher the pre-tax real financing cost (relative to the post-tax cost, and the higher will be the METR).

With today's low inflation, this arithmetic has brought about fairly high METRs. When inflation is higher and the nominal cost of debt is also higher, as

4 The opposing influence of inflation on tax-inclusive financing costs (for leveraged investments) may fully offset this phenomenon.

Table 1: *Statutory Corporate Income Tax Rates and Capital Structure by Industry, Canada, 2000 and 2004*

	Manu-facturing	Con-struction	Trans-portation	Communi-ations	Public Utility	Wholesale Trade	Retail Trade	Other Services
				Statutory Corporate Income Tax Rate (%)				
As of January 2000	36.5	43.1	43.8	43.2	43.1	42.0	43.0	42.7
Proposed, 2004[a]	32.3	34.0	34.5	33.5	33.7	32.9	33.5	32.8
				Capital Composition (%)				
Structures	23.2	36.5	17.2	74.7	61.1	13.7	17.0	58.6
Machinery	37.1	5.2	70.6	23.7	19.8	15.2	30.2	11.7
Inventory	37.5	50.9	10.6	0.6	17.2	67.5	49.2	11.5
Land	2.2	7.4	1.5	1.0	1.9	3.7	3.6	18.3

[a] Rates proposed for 2004 according to the federal and Ontario 2000 budgets.

Sources: Canada 2000; Ontario 2000; author's calculations.

it was as recently as the early 1990s, the pre-tax cost of financing is lower relative to the post-tax cost and, hence, the METR on land is lower than that on depreciable assets (Chen and Mintz 1993).

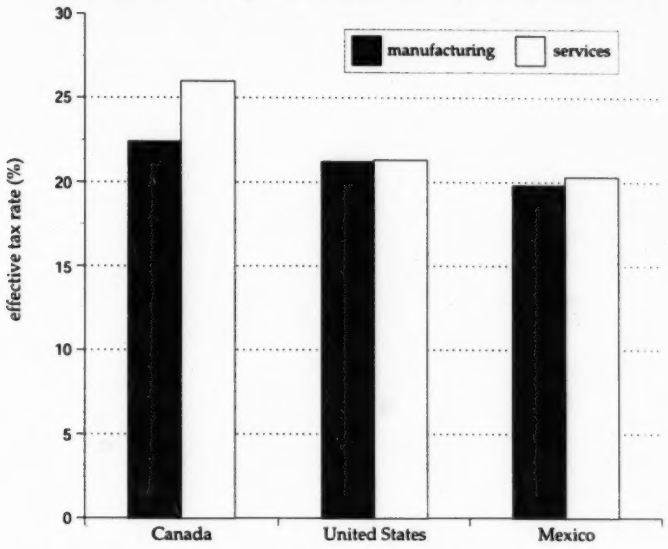
METRs by Industry

Given the differences in capital structures, statutory rates, and relevant capital cost allowance rates, it is not surprising to find METRs varying across industry sectors (see Figure 2).

It is instructive to compare the range of statutory tax rates versus METRs across industries (see Table 1). The combined statutory corporate income tax rate is about 6 percentage points lower for manufacturing than for other nonresource sectors. Thus, the manufacturing industry is the lowest-taxed nonresource industry in Canada, as confirmed in the comparisons in Figure 2. As the figure also shows, however, the METR for manufacturing is not much lower than those for communications or other services, which is perhaps surprising considering the gap between them in statutory rates. This is mainly because manufacturers hold much more capital in inventory — 37 percent versus 1 percent — and, as noted above, inventory is the highest-taxed class of assets. As a result, although manufacturers' assets are taxed at a lower rate than those of the communications sector, the gap in the METR between manufacturing and communications — less than 4 percentage points — is smaller than might be expected.

The opposite observation applies if one compares manufacturing and construction. The construction industry is not only taxed significantly higher on all its assets, it also holds a much higher share of capital (50 percent) in

Figure 3: ***Effective Corporate Tax Rates on Capital Investment in the Manufacturing and Services Sectors, NAFTA Countries, 2000***



Note: Does not include transportation, communications, or public utilities.

Source: Author's calculations.

inventory. As a result, the METR for construction is more than 12 percentage higher than for manufacturing, and it is the highest among all industries.[5]

METRs across Borders

Revisiting case 2, above, in which NAFTA country, assuming equivalent investment projects, should a Canadian manufacturer to expand its business line? The answer requires a crossborder comparison of METRs, as shown in Figure 3 (which includes figures for the services sector for reference).

The METR on capital invested by a Canadian manufacturer would be lower in the United States (21.2 percent) than in Canada (22.4 percent), and lower still in Mexico (19.8 percent). Although manufacturing is the lowest-taxed nonresource industry in Canada, a Canadian manufacturer would thus be better off investing in the United States or Mexico if business taxes were the only distinguishing feature across projects. Also, the gap in the METR between the manufacturing and services sectors is much wider in Canada than in the United States or Mexico, indicating that Canada's business tax system dislays a more severe intersectoral distortion than the tax systems of its NAFTA partners.

5 The wholesale and retail sectors also hold rather large shares of capital in inventory, but their METRs are lower than that of the construction industry, mainly because the former have significant capital shares invested in buildings, which have a high tax depreciation allowance.

Conclusion

The marginal effective tax rate is a crucial piece of information for making decisions about capital investment. In using the METR, however, decisionmakers must keep firmly in mind two key assumptions underlying the measure: that markets are perfectly competitive, and that firms behave as profit maximizers — which is to say that capital is fully mobile and firms chase the same goal.

This combination of assumptions makes tax-cost comparisons meaningful. If a firm is free to enter or exit a market in pursuit of profit, taxes will affect its investment decision. And among possible tax rate estimates, *only* the METR matters, since it alone bears on the decisionmaking margin. On the other hand, METR analysis is good only for evaluating the tax factors that bear on capital allocation decisions. It tells a comparative story about tax systems, but it does not tell non-tax stories that may be relevant, and such non-tax factors may play a more important role in investment decisions.

Finally, METR comparisons are always made either to show tax distortions across asset types and industries within a given tax regime, or to evaluate tax competitiveness across different tax regimes. The results are always informative for both investors and policymakers. These comparisons help investors to allocate or reallocate their capital in response to tax burdens that vary across industries or jurisdictions. Conversely, such comparisons allow policymakers to improve their tax systems by lessening distortions within their jurisdictions and ensuring that domestic rates are internationally competitive to the extent appropriate for meeting the country's economic goals.

References

Boadway, R., N. Bruce, and J.M. Mintz. 1984. "Taxation, Inflation, and the Effective Marginal Tax Rate in Canada." *Canadian Journal of Economics* 17 (1): 62–79.

Chen, D., and J.M. Mintz. 1993. "Taxation of Capital in Ontario and Canada." In A.M. Maslove, ed., *Business Taxation in Ontario*. Toronto: University of Toronto Press.

Canada. 2000. Department of Finance. *The Budget Plan 2000*. Ottawa. February 28.

Cordes, J.J., R.D. Ebel, and J.G. Gravelle, eds. 1999. *The Encyclopedia of Taxation and Tax Policy*. Washington, DC: Urban Institute Press in cooperation with the National Tax Association.

McKenzie, K.J., M. Mansour, and A. Brûlé. 1998. "The Calculation of Marginal Effective Tax Rates." Working Paper 97-15. Ottawa: Technical Committee on Business Taxation.

Mintz, J.M. Forthcoming. "A Eulogy for the Use of Average Tax Rates in Investment Equations." In J. Hines, ed., *Studies in International Taxation*. Chicago: University of Chicago Press.

Ontario. 2000. Ministry of Finance. *Ontario Budget 2000*. Toronto. May 2.

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